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SMITHSONIAN INSTITUTION • WASHINGTON, D.C.

Volume 123 1967 Number 3616

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A Review of the Genus *Euparixia* With Description of a New Species From Nests of Leaf-Cutting Ants in Louisiana (Coleoptera: Scarabaeidae)[1]

By Robert E. Woodruff and Oscar L. Cartwright[2]

The scarabaeid beetles of the genus *Euparixia* are exceedingly rare in collections, probably due to their inquilinous habits. Because of their rarity, Woodruff was elated to receive from Dr. John C. Moser the first Louisiana specimen of this genus, taken near Flatwoods, La., in a nest of the leaf-cutting ant, *Atta texana* (Buckley) (pls. 1, 2). Since only one species has been known to occur in the United States (in Arizona), this specimen was studied critically.

Subsequently, additional specimens were collected by Dr. Moser and forwarded to Cartwright for study. The authors agreed that these specimens represented an undescribed species and undertook a thorough treatment of the genus. During the course of this study, holotypes or paratypes were examined of all species except *E. duncani* Brown, for which topotypic examples were studied.

[1] Contribution No. 31, Florida Department of Agriculture, Division of Plant Industry, Entomology Section.

[2] Woodruff: Entomologist, Florida Department of Agriculture, Division of Plant Industry, Gainesville, Fla.; Cartwright: Curator, Division of Coleoptera, Department of Entomology, U.S. National Museum.

We wish to thank the following persons for assistance with this study and for the loan of specimens (abbreviations in parentheses are used in distribution records, which are quoted directly from museum labels under "Specimens Examined"): Dr. George W. Byers, Snow Entomological Museum, University of Kansas, Lawrence, Kansas (UK); Jose Carillo, Instituto Nacional Investigaciones Agricolas, Chapingo, Mexico (INIA); Dr. I. J. Cantrall, University of Michigan, Museum of Zoology, Ann Arbor, Michigan (UMMZ); Dr. P. J. Darlington, Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts (MCZ); Dr. Henry F. Howden, Canadian National Collection, Ottawa, Canada (CNC); J. N. Knull, Ohio State University, Columbus, Ohio (OSU); Hugh B. Leech, California Academy of Science, San Francisco, California (CAS); Dr. Milton W. Sanderson, Illinois Natural History Survey, Urbana, Illinois (INHS); Dr. Richard B. Selander, University of Illinois, Urbana, Illinois (UI); Dr. A. M. Villiers, Museum National d'Histoire Naturelle, Paris, France (MNHP); Dr. F. G. Werner, University of Arizona, Tucson, Arizona (UA); and Ing. Fernando de Zayas, Havana, Cuba (Z). We would especially like to thank Dr. John C. Moser, Southeastern Forest Experiment Station, Alexandria, La., for specimens and information on the new species.

BIOLOGY AND ECOLOGY.—It is not surprising that very little information is available on the biology of insects such as *Euparixia*, which have restricted and secretive habits. Fewer than 50 specimens are known for all five species of *Euparixia* and the immature forms are completely unknown. Most of the specimens represent *E. duncani* and were collected at electric lights. Three of the species (*E. formica* Hinton, *E. bruneri* Chapin, and *E. moseri*, new species) have been collected in the nests of leaf-cutting ants of the genus *Atta*. The genera *Euparia*, *Euparixia*, *Euparixoides*, and *Cartwrightia* seem to form a natural group in the Eupariini, all of which are apparently myrmecophilous.

Even though *Euparixia duncani* is represented by the greatest number of specimens, its host relationships have not been established; however, because of its similarity to the other species in the genus, we would also expect it to occur in the nests of leaf-cutting ants. Most specimens have been collected at Tucson and Globe, Ariz., where no species of *Atta* have been found. Another leaf-cutting ant, *Acromyrmex versicolor* (Pergande), does occur in this area and is the suspected host ant. Creighton (1950, p. 325) stated: "In both structure and habits the ants of the genus *Acromyrmex* show a close relationship to the genus *Atta*."

Presumably the beetles are scavengers and live in close harmony with the ants. Their occurrence at great depths (to 12 feet) would

certainly exclude them as accidental. They have been found in the active fungus gardens and in detritus chambers (pl. 2: fig. 2), which consist of old fungus and debris discarded by the ants. It is rather unlikely that they feed on the fungus grown by the ants (pl. 1: fig. 2) since no other members of the subfamily Aphodiinae are known to have this habit. If they actually fed on the fungus, competing with the ants, it would be likely that they would occasionally be thrown out of the nest. This has not been observed. All of the species except *E. costaricensis* (known from the unique type with incomplete data) and *E. moseri*, new species, have been collected at lights and possess fully developed wings.

The behavior of *Euparixia* within the nests has not been observed, and no evidence is available to determine if they are synechthrans (unwelcome guests), synoeketes (unnoticed or tolerated guests), or symphiles (true guests). The latter classification would seem most likely, but many diligent hours of observation will be necessary to determine the true role of *Euparixia*. Cazier and Statham (1962) and Cazier and Mortenson (1965) have made numerous observations on the myrmecophilous scarab genus *Cremastocheilus* and in at least one case, *C. stathamae* Cazier, the adult beetles were found to be obligatory predators on the ant larvae. We have no evidence for similar habits in *Euparixia*. Moser (pers. comm.) believes that the adult, at least, is tied to the ecology of the fungus garden, since all but one of the specimens have been collected in this niche. The numerous species of inquilines associated with detritus cavities are practically never found in fungus gardens.

Certainly many ecological factors are unique in the complicated and extensive underground passages of these fungus-growing ants. Wheeler (1900, p. 855) postulated that the vast amounts of comminuted and decomposing vegetable matter collected by the ants as a soil or culture medium for their fungus would be a favorable resort for numerous myrmecophiles. Walter, Seaton, and Mathewson (1938) record approximately 50 species of insects and arachnids found within the nests in association with *Atta texana* at San Antonio, Tex. They record two scarabs in the subfamily Cetoniinae but no members of the genus *Euparixia* or the subfamily Aphodiinae. Moser (1963) has found a considerable number of interesting myrmecophiles in his studies of the biology and ecology of this ant in Louisiana (some of these have been described by Sabrosky, 1959; Spangler, 1962; and Chillcott, 1965).

Weber (1958, p. 459) stated that the true culture of fungi is confined to the New World ants of the tribe Attiini, all known species of which are dependent on fungus gardens for food. The genus *Atta* is considered to be the most highly developed in the tribe, in

terms of biology, behavior, and morphology. *Acromyrmex* is considered to be nearest it on a phylogenetic basis. It is possible that species of *Euparixia* or related genera might occur with other ant genera in this tribe, namely *Cyphomyrmex*, *Mycetophylax*, *Mycocepurus*, *Myrmicocrypta*, *Apterostigma*, *Sericomyrmex*, and *Trachymyrmex*. The nests of few species of *Atta* or related genera have been investigated thoroughly for inquilines. Certainly the complex association between ants, fungus gardens, and beetles has taken considerable time to evolve. Weber (1958, p. 460) postulated that the South American tropical forests may have been the original home of the attine ants and their fungi, and that this symbiosis may have become established during a period nearly 50 million years ago. Since most attine ants are presently found in South America, it would be surprising if no eupariine scarabs occupied this niche on that continent.

DISTRIBUTION. (fig. 1).—The distribution records for the few specimens available indicate that the species of *Euparixia* are allopatric. It is highly probable that each species of beetle occurs with only one species of ant, but the distribution probably is much more extensive than presently known. The known distribution of the five species of *Euparixia* is as follows: *E. bruneri* Chapin from Baragua, Camaguey, and Santiago de las Vegas, Cuba; *E. costaricensis* Hinton from an undetermined locality in Costa Rica; *E. formica* Hinton from Tejupilco, Mexico; *E. duncani* Brown from southern Arizona and northwestern Mexico; and *E. moseri*, new species, from southwestern Louisiana.

Borgmeier (1959) lists 14 species of *Atta*, most of which occur in South America but no *Euparixia* have been found there. Smith (1963) summarizes the United States and Mexican distribution of the genus *Atta*. Using the known distribution of the ants (fig. 1), we can postulate the probable distribution of the myrmecophilous *Euparixia*. *E. bruneri* Chapin probably occurs with *A. insularis* Guerin throughout the island of Cuba although it has been found only at two localities. *E. formica* Hinton has been recorded as associated with *A. sexdens* (L.)(Hinton, 1934), which has the greatest range of the species of *Atta*. It has been reported from Panama, Colombia, Ecuador, Bolivia, Venezuela, Guiana, Surinam, Brazil, Paraguay, Argentina, and Uruguay; however, it is not recorded from Mexico and the records of Hinton (1934) for this host probably refer to *A. mexicana* Frederick Smith, which is widely distributed in Mexico and recorded from El Salvador and extreme southern Arizona. *A. cephalotes* (L.) is recorded also from southern Mexico (Vera Cruz, Cordova, and Oaxaca), Central America, Ecuador, Colombia, Venezuela, Peru, Bolivia, Guiana, and Brazil but not within the known

range of *E. formica*. *E. costaricensis* Hinton occurs within the range of *A. cephalotes*, whose range is given above, and *A. colombica* Guerin, which has been recorded from Colombia, Panama, Costa Rica, and Guatemala. *E. moseri*, new species, undoubtedly has a

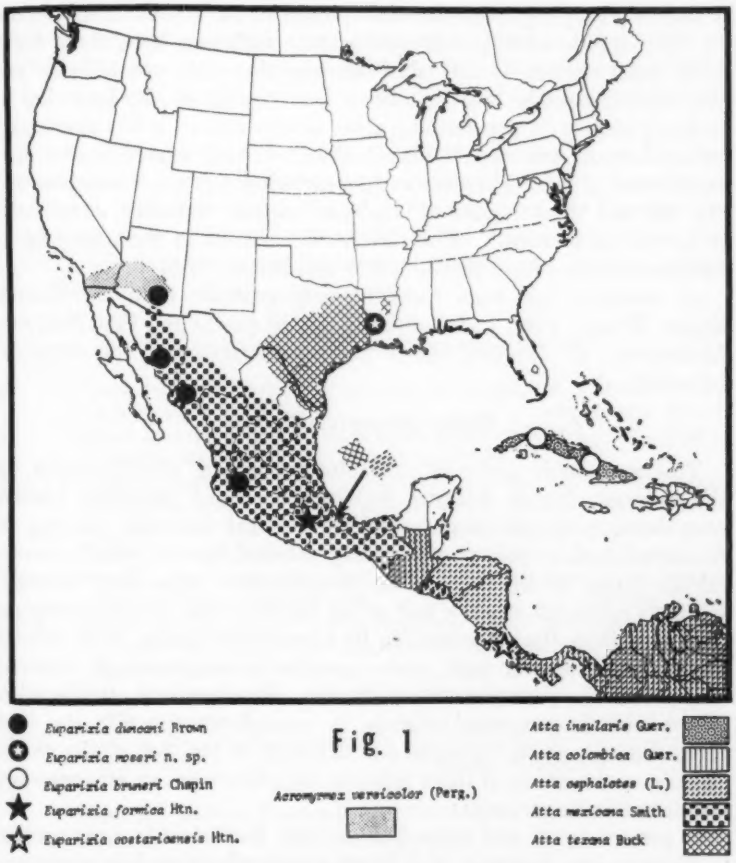


FIGURE 1.—Distribution of the leaf-cutting ants of the genus *Atta* and of the species *Acromyrmex versicolor* Pergande, and the scarab beetles of the genus *Euparixia* in North America. (Drawn by R. E. Woodruff.)

wider range than the few areas now known in southwestern Louisiana, since its host, *A. texana*, occurs over much of the eastern two-thirds of Texas also. Although the host is not established for *E. duncani*, we suspect it is *Acromyrmex versicolor* (Pergande). Creighton (1950)

and Cook (1953) record this ant from southern Arizona, Mojave Desert, and Yucca, Calif., and the type-locality is Calamajuit, Baja California, Mexico. There is a disjunct subspecies, *A. v. chicosensis* (Wheeler), which is recorded from the mountains of the Big Bend area of Texas.

Jones (1917) reported the first record of *A. texana* in Louisiana in 1914, but local residents stated these ants had been there for a long time. Smith (1939) also believed that this species was not introduced recently into Louisiana, but "owing to the fact that it is found largely on non-farming areas or wastelands, it has previously escaped much attention." Smith (1951, p. 832) stated that it had been found in "much of western Louisiana and eastern Texas between the 92d and 101st degrees of longitude but not uniformly distributed in Louisiana at least." The distribution shown on the map (fig. 1) has been derived from Smith (1963) and Moser (in litt.).

A. mexicana has been recorded only recently from the United States (Byars, 1949, and Smith, 1951), in the Organ Pipe National Monument of Arizona about five miles north of the Mexican boundary.

Genus *Euparixia* Brown

This monobasic genus is characterized among the Eupariini by the inflexed clypeal margins, explanate pronotal margins, basally constricted pronotal sides, cariniform elytral intervals (except in *E. costaricensis*), epipleurae covering external tips of middle coxae, middle coxae widely separated, mesosternum expanding laterally to partly cover the anterior half of the middle coxae, the mesosternum separated from the metasternum by a transverse carina, long slender middle and posterior tarsi, and a peculiar arrangement of terminal fimbriae of the posterior tibiae (fig. 9). The terminal outside edge of the tibia is excavated slightly or emarginate opposite the first tarsal segment, with the spurs and one seta on one side of the emargination and a group of three setae on the other side, an arrangement also found in *Euparixoides*.

In general facies and clypeal characters, *Euparixia* is most similar to *Euparixoides;* however, this latter monotypic genus has pronotum laterally and basally, and clypeus anteriorly, noticeably crenate. It has a basally impressed pronotal midline, normally convex elytral intervals, a single terminal spur on middle and posterior tibiae (fig. 12), and middle and hind legs with short, tapering tarsi about half the length of the tibiae. The crenate anterior clypeal margin in *Euparixoides* is unique in the Aphodiinae so far as we know.

Euparixia in many respects is also quite close to *Cartwrightia* even though the latter has more of the appearance of *Ryparus*. *Eu-*

parixia agrees with *Cartwrightia* in the explanate pronotal margin, basally constricted pronotum, epipleurae covering the tips of the widely separated middle coxae, and the mesosternum extending laterally more or less over part of the anterior half of the mesocoxae. In *Cartwrightia*, however, the clypeus is not inflexed at the apex, the margins and surface of the pronotum are very different, and only alternate elytral intervals are carinate. Apically the elytra of *Cartwrightia* are very much as in *Ryparus*. *Cartwrightia* seems to be intermediate between *Euparixia* and *Ryparus*, combining characters from each.

In the explanate pronotal sides *Euparixia* is similar to *Euparia* but *Euparia* lacks the inflexed clypeal apex, the basally constricted pronotum, and cariniform elytral intervals; and in *Euparia* the epipleurae do not cover the anterior tips of mesocoxae; the mesosternum is normally narrow between the coxae and does not extend laterally over the coxae.

Key to Species of Genus *Euparixia* Brown

1 Elytral intervals moderately convex, not cariniform; pronotal outline as in figure 7; Costa Rica . . . . . **costaricensis** Hinton

1′ Elytral intervals cariniform as in figure 5; pronotal outline not as above; southern Mexico to Louisiana, including Cuba 2

2 (1′) Pronotum constricted only in posterior one-third, the posterior angles prominent and acute (fig. 2); Arizona and N. Mexico . **duncani** Brown

2′ (2) Pronotum constricted in posterior one-half or more, the posterior angles evident but rounded (figs. 3–5); distribution not as above 3

3 (2′) Lateral pronotal margin less explanate, outline as in figure 4, the posterior angles evident; central Mexico . . . . . **formica** Hinton

3′ (3) Lateral pronotal margin broadly explanate, outline as in figures 3 and 5, the posterior angles obscured, nearly obliterated; Cuba and Louisiana 4

4 (3′) Angle of the pronotal constriction more acute (fig. 3); Cuba; host: *Atta insularis* . . . . . **bruneri** Chapin

4′ (4) Angle of the pronotal constriction less acute (fig. 5); Louisiana; host: *Atta texana* . . . . . **moseri** Woodruff and Cartwright

Euparixia moseri Woodruff and Cartwright, new species[3]

FIGURE 5

Holotype: Length 4.8 mm, width 2.2 mm. Elongate, convex, feebly shining, reddish brown, basal margin of pronotum and legs darker.

Head: Clypeus widely truncate between weak angles, distance between angles greater than length of the feebly arcuate side from

[3] This remarkable species is named in honor of Dr. John C. Moser, who is the only person to collect the species and who has discovered many interesting myrmecophiles in his fine work on the biology and ecology of *Atta texana* in Louisiana.

angle to slight genal notch; clypeal margin feebly recurved, apically inflexed ventrally at middle; genae prominent, nearly right angled. Surface finely, quite closely granulate along anterior margin and more widely upward at sides, median tumidity gradually smoother to faint rugulose sculpture over middle and gradually to fine dense punctures upward over frontal area, slightly larger punctures at occipital areas. Frontal suture visible at sides.

Pronotum: Pronotum broader than long (greatest width compared to length measured along center line: width 1.9 mm, length 1.4 mm), very convex. Punctures very coarse and close over basal half, then gradually less coarse and less dense anteriorly, almost impunctate narrowly along anterior margin and over the widely explanate sides anteriorly. Anterior angles broadly rounded. Posterior angles obliterated by constriction and loss of lateral areas over basal two-thirds of pronotum. Pronotum much narrower at base than the width of the elytra between the humeri. Pronotal outline characteristic, differing from other known species (fig. 5).

Elytra: Suboval, widest at apical one-third; intervals strongly carinate, under × 50 magnification the crest of the carina shows minute very close punctures giving a roughened edge; striae deep, punctures fine, deep, and placed at junction of very coarse elliptical or oval depressions that are bordered by a very fine carina. At first glance the striae appear to be simply a chain of very coarse, very close, deep punctures but clean specimens show the fine, deeper punctures between them. Scutellum narrow, about three times as long as wide, smooth with an anterior depression at middle.

Sternum: Prosternum angulate posteriorly at middle. Mesosternum with coxae widely separated basally by slightly more than length of trochanter of middle leg; smooth median depressed area with straight diverging carina-like edge extending three-fourths the distance from sharply delimited base, which is slightly raised above metasternum and ending anteriorly in a wide, shallow depression; laterally, outside depressed median area, flat borders overlap the edges of anterior half of mesocoxae. Mesocoxa smooth basally, finely, closely, setigerously punctate over anterior half between overlapping edges of mesosternum and epipleuron of elytron. Metasternum shallowly depressed medially with moderately deep, complete midline; depression in front of posterior coxae with sharply delimited, arcuate anterior border; laterally metasternum extending far forward between mesocoxae and epipleurae of elytra, bordered here by a finely carinate edge. A few fine to moderate, shallow punctures at base of mesocoxae.

Abdomen: The first three of four visible segments longer at sides than middle, terminal segment longer at middle; all bordered anteriorly

by series of longitudinal carinae enclosing square or rectangular punctures or pits, these rows of depressed squares on first two segments not quite as long as remainder of segment at middle, but rapidly decreasing from lateral fourth to zero at extreme sides; on third segment the depressed squares about as on preceding segments but occupying practically all of the segment at its shortened middle length; terminal segment carinae about two-thirds the segment length at middle; first two segments bordered posteriorly with very close, fine punctures; remaining surface of all segments with scattered fine to medium punctures at middle; very large shallow punctures at sides. Pygidium with roughened eroded area, basally separated by a longitudinal carina.

Legs: Anterior tibia sharply tridentate, middle tooth nearer the basal one than to the apical one. Apical tooth broad, bent outward at nearly a right angle to tibia. Apical spur elongate, narrow, gently curved toward outer tibial margin, flattened, concave beneath, slightly longer than combined length of first three tarsal segments. Single row of about seven short setae on outer tibial margin between base and basal tooth, and one seta on each side of each tooth, with a few scattered setae beneath. Length ratio of tarsal segments: 2–1–1–1–2; claws simple. Anterior femur broad, with perimarginal groove; surface with close moderate punctures bearing extremely short, fine, almost invisible setae; three coarse setae on anterior edge beginning at trochanter and extending one-fourth the femur length. Trochanter exceptionally large, slightly longer than width of femur, finely margined, surface very finely alutaceous. Middle femur long, slender, slightly arcuate, complete posterior marginal groove, surface with moderately close, fine punctures set with extremely short setae; tibia straight, very weakly gradually expanded to twice basal width (fig. 9); terminal ventral edge excavated opposite tarsus with one seta next to spur and three beyond the emargination; first tarsal segment equal to combined length of next three, terminal segment slightly longer than second; claws simple. Posterior leg similar to middle except that the posterior femoral groove extends only half the distance from knee to base.

Diagnosis: Differs from known species in the shape of the pronotal outline (fig. 5), but similar to *E. bruneri* Chapin. Aside from its distribution and host ant, it can be distinguished from *bruneri* by the less acute angle in the middle of the constricted side margin and less angulate posterior of the explanate margin. It is somewhat similar to *E. formica* Hinton but differs by possessing impunctate meso- and metasternum and in the shape of the pronotal outline.

Specimens examined: Total 7. Holotype: Melder, Louisiana, 11 April 1961, J. C. Moser, 2 feet deep in nest of *Atta texana* [USNM No. 68930]. Paratypes:

3 same data as holotype [USNM]; 1–I'nt. [International] Paper Company Excav. [Excavation], T1N, R3W, S11, La., John C. Moser, in nest of *Atta texana*, excav. 3/24/60, 12 feet, F. G. [fungus garden] [USNM]; 1–I'nt. Paper Co. Excav., T2N, R3W, S10, La., John C. Moser, in nest *Atta texana*, March 25, 1960, central cavity, in fungus garden [USNM]; 1-near Flatwoods, La., T4N, R4W, S30, nest *Atta texana*, 30, Dec. 1958, J, Moser, 5 ft. detritus cavity (Woodruff).

Host: (See under "Biology and Ecology" and "Distribution".) Known only from nests of *Atta texana* (Buckley) in Louisiana. The distribution of this ant is shown on the map (fig. 1).

Euparixia duncani Brown

FIGURE 6

Euparixia duncani Brown 1927, pp. 288–289. [Type: Globe, Ariz.; Canadian National Collection.]

Length 5.0 to 5.75 mm, width 2.0 to 2.4 mm. Elongate, convex, feebly shining (often encrusted with light-colored dirt), reddish brown, darker at clypeal and posterior pronotal margin. Legs and venter similarly colored but slightly darker than dorsum. Pronotum constricted basally at sides with anterolateral margin explanate.

Head: Clypeus truncate across middle one-third, sides feebly curving to prominent genal lobes. Eyes not visible when head is in repose. Clypeal apex inflexed ventrally at middle. Head finely, densely punctured on basal one-third, gradually diminishing to slightly granulate at middle and evenly, finely granulate on anterior one-third.

Pronotum: Broader than long, convex. Punctation like pits at base but becoming less coarse and less dense toward anterior band. Lateral explanate portion nearly impunctate. Sides explanate on anterior two-thirds; posterior angle obliterated, but the one at constriction acute (nearly 90°). Pronotum much narrower at base than the elytra. Pronotal outline as in figure 2.

Elytra: Together suboval, widest at apical one-third; intervals acutely carinate, striae deep, punctate. The lateral cariniform margin forms a "tooth" on each side in front of humeri. Punctures complicated, but appearing quadrate on disc, gradually becoming less distinct toward sides. Carinate intervals with single row of regularly spaced, very minute, short setae in center. Scutellum elongate, depressed basally at middle.

Sternum: Prosternum weakly angulate posteriorly at middle. Mesosternum with coxae widely separated basally by more than length of trochanter of middle leg; median area smooth but alutaceous, bordered laterally by a raised, flattened, smooth, diverging, slightly arcuate border that quickly widens from a fine carina at base of the coxa to the wide flat edge overlapping the coxal edge from basal

fourth to the epipleuron of the elytron; median area slightly more depressed anteriorly and roughened by close, fine to moderate punctures. Mesosternum and metasternum separated by a fine transverse carina that sometimes has a median longitudinal carina extending a short distance anteriorly and posteriorly. The latter carina gives way quickly to a long, coarse, deep, median line or sulcus. The bordering carina around posterior end of middle coxa becomes very noticeably heavier and separated from disc of metasternum by a coarse deep punctate sulcus; remainder of disc alutaceous and with fine to moderate, close punctures outward from midline; depressed area in front of posterior coxae alutaceous, the arcuate anterior margin deep and sharply bordered; sides scabrous outward and forward between coxa and epipleuron.

Abdomen: Each abdominal sternite depressed on anterior one-half; this depression with longitudinal ridges irregularly spaced. The posterior one-half of each sternite coarsely, irregularly punctate. Pygidium nearly concealed, a transverse depression paralleling the apical border and a longitudinal depression in middle, reaching to transverse depression.

Legs: Anterior tibiae tridentate; apical tooth broad, bent outward at nearly right angle to tibia. Apical spur elongate, narrow, slightly longer than combined length of first three tarsal segments. Anterior trochanter large, prominent, impunctate, rugose ventrally. Anterior femoral groove and about one-half the dorsal surface of femur covered with fine, short, golden setae. Posterior femur with marginal groove covering one-half the length from the apex. Terminal spurs of middle and posterior tibiae unequal: the longer one is four-fifths the length of the first tarsal segment; shorter spur two-thirds the length of the longer one. Middle and posterior tibiae nearly straight, narrow, slightly curving outward toward the weakly expanded apex. First segment of middle and posterior tarsi equal in length to next three segments combined.

Diagnosis: This species, the type of the genus, differs from all known species in the shape of the pronotal outline (fig. 2). The basal constriction is less extensive, creating a broader explanate margin than in any other species. The angle formed at the constriction more acute. It differs further in its distribution and, although its host ant is not known, probably differs in this respect also. It is the most common species in collections and with *E. moseri*, new species, comprises the only two species in the United States.

Specimens examined: Forty-one from the following localities: ARIZONA: 1-Globe, 20-VII-33, F. H. Parker, Lot 3, from O. Bryant Colln., Topotype [CAS]; 2-Globe, VIII, Duncan and Parker, R. Hopping Colln. [CAS]; 1-Globe, VIII, Duncan and Parker [UK]; 1-Globe, 15-VII-27, Duncan and Parker,

O. L. Cartwright Colln. [USNM]; 1-Globe, VIII, Duncan and Parker, O. L. Cartwright Colln. [USNM]; 1-Globe, 24-VIII-52, F. H. Parker, O. L. Cartwright Colln. [USNM]; 1-Tucson, 5-VIII-35, Bryant, 20, Van Dyke Colln. [CAS]; 1-Tucson, 16-VIII-35, R. H. Beamer, coll. at light, L. W. Saylor [CAS]; 8-Tucson, 16-VIII-35, R. H. Beamer, coll. at light [UK]; 2-Tucson, 5-VIII-35, Bryant 20 [INHS]; 1-Tucson, 10-VII-59, K. Radford, blacklight trap [UA]; 1-Tucson, 2-VIII-13, Shive [USNM]; 1-Tucson, 16-VIII-35, R. H. Beamer, M. Robinson Colln. [USNM]; 1-Tucson, 30-VIII-13, J. Shive, Liebeck Colln. [MCZ]; 2-Tucson 1-VIII-13, J. Shive [MCZ]; 1-Tucson, 5-VIII-35, Bryant, C. A. Frost Colln. [MCZ]; 1-Tucson, 10-VIII-59, K. Radford, u.v. lt. trap [UA]; 2-Wickenburg, 20-VIII-38, D. J. and J. N. Knull [OSU]; 1-Wickenburg, 20-VIII-38, D. J. and J. N. Knull, M. Robinson Colln. [USNM]; 1-Douglas, X-1963, J. H. Russell, blacklight [USNM]; 1-Douglas, summer 1964, J. H. Russell, blacklight [USNM]; 1-Palmerlee, Huachuca Mtns. [AMNH]; 1-Hope, Yuma Co., 12-VIII-48, greasewood desert, 1400 feet, at light, F. Werner and W. Nutting [UA]; 1-Sabino Canyon, Catalina Mtns., Pima Co., 26-VII-55, F. G. Werner and G. D. Butler [UA]; 1-Palo Alto, 29-30-VII-16, Mark Robinson Colln. [USNM]. MEXICO: 1-San Bernardo, Rio Mayo, L. W. Saylor Colln. [CAS]; 1-Durango, "enter identification Care No. 1830, Bufo [X]," L. W. Saylor Colln. [CAS]; 1-Acatlan, Puebla, 7-V-57, cerca luz, Wm. W. Gibson [INIA]; 1-Venodio, Sin., 17-V-18, J. A. Kusche [probably Venadillo (Boyle, 1956, and Cantrall, in litt.)]; 1-Tepic, ex Museo H. W. Bates, 1892, Oberthur Colln. [MNHP]; 1-Ajijic, Jalisco, 21-VI-64, W. L. Nutting, 5140 feet [UA]; 1-Ajijic, Jalisco, 16-VII-64, W. L. Nutting, u.v. lt. trap [UA].

Host: The host has not been established for this species even though it is the most abundant in collections. We suspect that it is associated with *Acromyrmex versicolor* and/or *Atta mexicana* although the latter is not known from Tucson or Globe, Ariz., where most of the *E. duncani* have been found. (See also under "Biology and Ecology.")

Euparixia bruneri Chapin

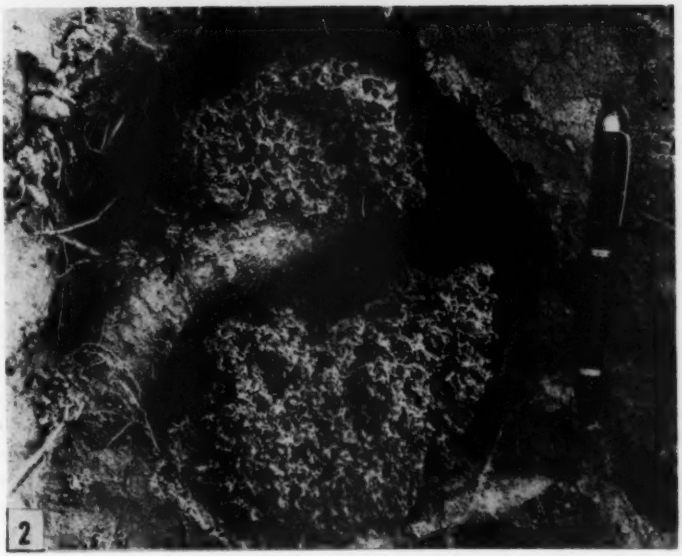
FIGURE 3

Euparixia bruneri Chapin 1940, pp. 40–41. [Type: Baragua, Cuba; U.S. National Museum, No. 53329.]

Length 5.25 mm, width 2.14 mm. Elongate, convex, feebly shining (often encrusted with reddish dirt), reddish brown. Pronotum constricted at side on posterior one-half; sides broadly explanate on anterior one-half.

Head: Clypeus truncate across middle one-third, sides feebly curving to prominent genal lobes. Eyes not visible when head is in repose. Clypeal apex inflexed ventrally at middle. Head finely, densely punctured on basal one-third, gradually diminishing to slightly granulate at middle and evenly, finely granulate on anterior one-third.

Pronotum: Broader than long, very convex. Punctation like pits at base, becoming less coarse and less dense toward anterior



FIGURES 1, 2.—1, Large nest of *Atta texana* showing mound of excavated subsoil at central area; 2, fungus garden made by *A. texana* (roots often provide support for the gray spongy fungus growing on bits of vegetation supplied by the ants). (Photos courtesy U.S. Forest Service.)

FIGURES 1, 2.—1, Dr. J. C. Moser examining the barrel-sized "central cavity" in a large nest (these cavities are usually 8–12 feet below soil surface); 2, detritus cavities are special holes dug for deposit of exhausted fungus gardens, deceased ants, and other refuse (most species of inquilines are found here). (Photos courtesy U.S. Forest Service.)

band. Large punctures often confluent, forming narrow ridges between. Lateral explanate portion nearly impunctate. Sides explanate in anterior one-third with anterior angles broadly rounded. Posterior angle barely evident but indicated by definite constriction (this angle more prominent than in *E. moseri*, new species). Pronotum much narrower at base than the elytra. Pronotal outline as in figure 3.

Elytra: Together suboval, widest at apical one-third; intervals acutely carinate, striae deep, punctate. The lateral cariniform margin forms a "tooth" on each side in front of humeri. Punctures complicated, but appearing quadrate on disc, gradually becoming less distinct toward sides. Carinate intervals with single row of regularly spaced, very minute, short setae in center. Scutellum elongate, depressed basally at middle.

Sternum: Mesosternum very similar to that of *E. duncani* except that the alutaceous sculpture of the middle depressed area extends forward only three-fifths of length, the anterior two-fifths is smooth and shining with close moderate punctures, the middle is more distinctly impressed, the anterior one-fifth more or less convex, the anterior border very distinct and the inner edge of the flat diverging lateral margins is noticeably irregular, not so smooth an edge as in *E. duncani*. The metasternum is also similar to *E. duncani* but much smoother with the punctures very fine except for a few coarse close punctures between middle coxae and the arcuate forward edge of the depression in front of the posterior coxae.

Abdomen: Each abdominal sternite depressed on anterior one-half; this depression with longitudinal ridges irregularly punctate. Pygidium nearly concealed, a transverse depression paralleling the apical border and a longitudinal depression in middle, reaching to transverse depression.

Legs: Anterior tibiae tridentate; apical tooth broad, bent outward at nearly right angle to tibia. Apical spur elongate, narrow, slightly longer than combined length of first three tarsal segments. Anterior trochanter large, prominent, impunctate, rugose ventrally. Anterior femoral groove and about one-half the dorsal surface of femur covered with fine, short, golden setae. Posterior femur with marginal groove covering one-half the length from the apex. Terminal spurs of middle and posterior tibiae unequal: the longer one four-fifths the length of the first tarsal segment; shorter spur two-thirds the length of the longer one. Middle and posterior tibiae nearly straight, narrow, slightly curving outward toward the weakly expanded apex. First segment of middle and posterior tarsi equal in length to next three segments combined.

Diagnosis: Differs from all known species in shape of the pronotal outline (fig. 3), but most similar to *E. moseri*, new species, in this respect. It can be separated from this species by the more prominent angle at the middle of the constriction and by the angle of the posterior portion of the explanate sides pointing more outward and making a more acute angle. It also differs in geographic distribution and host ant.

Specimens examined: Total 4; 1—[holotype no. 53329] Cuba, Camaguey, Baragua, V–24–32, at light, Christenson [USNM]; 1—[paratype no. 53329] Cuba, E.E.A. Estacion Experimental Agricola Ento. No. 11,268, Santiago, de las Vegas, Havana, May 2, 1946, Ing. Naranjo, en nido de bibijagua [USNM]; 1—near Havana, Cuba, Fernando de Zayas (Z); 1—[paratype no. 53329] Santiago de las Vegas, Havana, Cuba, July 20/24, det. '36 H. E. Hinton as *Euparixia formica* Hntn. [USNM].

Host: *Atta insularis*, which is known only from Cuba and is most closely related to *Atta texana*.

Euparixia formica Hinton

FIGURE 8

Euparixia formica Hinton 1934, pp. 27–28. [Type: Tejupilco, Mexico; California Academy of Sciences.]

Length 4.65 mm; width 1.95 mm. Elongate, convex, feebly shining, dark reddish brown. Pronotum constricted basally at sides with the anterolateral margin narrowly explanate.

Head: Clypeus truncate across middle one-third, sides feebly curving to prominent genal lobes. Eyes not visible when head is in repose. Clypeal apex inflexed ventrally at middle. Head finely, densely punctured on basal one-third, gradually diminishing to slightly granulate at middle and evenly, finely granulate on anterior one-third.

Pronotum: Broader than long, very convex. Punctation like dense, coarse pits at base, becoming less coarse and less dense toward anterior band. Lateral explanate portion nearly impunctate. Sides explanate narrowly on anterior two-thirds; posterior angle obliterated, but the one at the constriction rounded, gradually sloping to base. Pronotum much narrower at base than the elytra. Pronotal outline as in figure 4.

Elytra: Together suboval, widest at apical one-third; intervals acutely carinate, striae deep, punctate. The lateral cariniform margin forms a "tooth" on each side in front of humeri. Punctures complicated, but appearing quadrate on disc, gradually becoming less distinct toward sides. Carinate intervals with single row of regularly spaced, very minute, short setae in center. Scutellum elongate, depressed basally at middle.

Sternum: The mesosternum is similar to *E. duncani* and *E. bruneri* but the depressed, median, very finely alutaceous area is sharply outlined and obovate in shape, the edge of the anterior half of this area, as well as the edge of the flattened diverging borders, irregularly cut into by the close, deep, coarse, longitudinally elongate punctures that cover all the anterior part of mesosternum. Metasternum as in *E. duncani* but disc covered with rather close, shallow, moderate punctures and alutaceous sculpture; a few coarse, close punctures between mesocoxae and the arcuate anterior border of the depressed area in front of the posterior coxae; lateral area between mesocoxae and sides strongly bordered by groove of coarse punctures, otherwise a very few punctures and scattered small tubercles.

Abdomen: Each abdominal sternite depressed on anterior one-half, this depression with longitudinal ridges irregularly spaced. The posterior one-half of each sternite coarsely, irregularly punctate. Metasternum with median sulcus moderately impressed, covering entire length; entirely punctate as in the femur (including depression where femur rests). Pygidium nearly concealed, a transverse depression paralleling the apical border and a longitudinal depression in middle reaching to transverse depression.

Legs: Anterior tibiae tridentate; apical tooth broad, bent outward at nearly right angle to tibia. Apical spur elongate, narrow, slightly longer than combined length of first three tarsal segments. Anterior trochanter large, prominent, impunctate, rugose ventrally. Anterior femoral groove and about one-half the dorsal surface of femur covered with fine, short, golden setae. Posterior femur with marginal groove covering one-half the length from the apex. Terminal spurs of middle and posterior tibiae unequal: the longer spur four-fifths the length of the first tarsal segment; shorter spur two-thirds the length of the longer one. Middle and posterior tibiae nearly straight, narrow, slightly curving outward toward the weakly expanded apex. First segment of middle and posterior tarsi equal in length to next three segments combined.

Diagnosis: Small for the genus and darker than usual. Differs from all known species in pronotal outline (fig. 4). The explanate margin is narrower than *E. duncani*, *E. bruneri*, or *E. moseri*. It differs from *E. bruneri* and *E. moseri* in having the metasternum punctate. It differs further from *E. duncani* in the rounded angle at the constriction rather than an acute one. It also differs from all others in distribution and host ant species.

Host: Recorded by Hinton (1934) as being found with *Atta sexdens* at the type-locality, but that species is not now known from Mexico and this record probably refers to *Atta mexicana*. Although this

ant has a wide distribution, as shown in figure 1, *E. formica* is known only from the type-locality in south central Mexico.

Specimens examined: 1—Tejupilco, Mex., Temascaltepec, 23-VI-33, H. E. Hinton and R. L. Usinger, Paratype No. 54675 [USNM].

Euparixia costaricensis Hinton

FIGURE 7

Euparixia costaricensis Hinton 1936, pp. 274–275. [Type: Costa Rica; United States National Museum, No. 54674.]

Holotype: Length 4.5 mm, width 2.2 mm. Elongate, convex, moderately shining, very dark brown with margins of pronotum and head reddish brown. Legs and venter similarly dark brown.

Head: Clypeus widely, shallowly emarginate between small triangular teeth, apex inflexed ventrally at middle; sides very weakly reflexed and weakly arcuate, length from teeth to right-angled, moderately sharply rounded genae equal to that between the teeth. Head moderately convex, weakly rugose in front between teeth, very fine, well-separated punctures, separated by three diameters, over anterior of median convexity and outward toward genae, gradually elongate, larger and closer, to dense, coarse and round across the base. Frontal suture not visible.

Pronotum: Subquadrate; width 1.8 mm, length 1.2 mm. Anterior angles broadly rounded; posterior angles noticeably angulate and rather sharply rounded; base strongly margined, broadly evenly arcuate, the line of curvature continuing forward inside the posterior angles. Lateral margin with a slight but noticeable angle slightly in front of the middle. Surface deeply impressed laterally at anterior third behind the eyes, leaving the anterior angles wide, flat, and explanate, this flattened margin continued narrowly posteriorly to and including the posterior angles; another rather deep, elongate depression paralleling the base, midway between anterior and posterior margins with the ends of this fovea equidistant from the edges of the pronotum and the deeply impressed midline, which diminishes in depth from base to middle; except for the flat anterior angles and lateral margins, which show a few shallow moderate punctures and alutaceous sculpture, the entire surface is strongly and closely punctate, the punctures very coarse in the midline, between, in, and behind the lateral foveae, forward the size gradually smaller with intermixed fine punctures toward the anterior margin, where all are of uniform diameter. A few scattered short, erect setae show in glancing light over the flattened anterior angles.

Elytra: Together elongate oval, convex, widest slightly behind middle. Humeri strongly dentate. Striae strong with deep elongate

punctures separated by less than their length; intervals convex, with very fine, quite close punctures bearing extremely short, fine setae visible in glancing light. Scutellum small, elongate, flat, with two small punctures basally.

Sternum: Coxae of mesosternum widely separated, the distance between them barely more than the length of trochanter of middle leg; mesosternum between the coxae with sharply margined, slightly depressed area shaped like an inverted pear, with a wide, deeply eroded line around the larger forward end of the pear, the median area sloping forward into a wide, deep pit or fovea, the pit sharply margined laterally and anteriorly; this intercoxal area relatively smooth posteriorly and separated from the metasternum by a transverse carina. Metasternum with a more or less pentagonal flat area, with a deep, wide eroded line around each middle coxa, and with a similar, long, deeply eroded midline, this latter separated anteriorly from the coxal lines by a smooth area equalling its own width; the pentagonal area otherwise everywhere with well-separated fine punctures and with three or four coarse punctures immediately behind each mesocoxa; a very large, deeply eroded, anteriorly strongly arcuate area extending almost to sides in front of posterior coxae.

Abdomen: The first three of four visible segments longer at sides than middle, terminal segment slightly longer at middle; last three segments bordered anteriorly by series of longitudinal carinae enclosing square or rectangular punctures or pits, those of the anterior segment uniform from side to side, enclosing square punctures, those at middle of the next twice as long as preceding and gradually much longer at sides, those of the terminal segment long at middle and decreasing in length toward sides; surface of first two visible segments with scattered, very moderate, shallow punctures at middle to coarse at sides. Posterior edge of the segments bordered at middle by a row of close-set smaller punctures that become very close, deep, and very coarse at extreme sides, this area appearing undercut by the punctures; third visible segment smooth except for two or three punctures at extreme sides; terminal segment and most of pygidium apparently eaten on one side by a dermestid but remainder of segment with scattered moderate punctures.

Legs: Anterior tibiae normal, sharply tridentate, the middle tooth slightly nearer apical tooth, the basal tooth equidistant from base to tip of apical tooth. Spur slender, acuminate, not as long as first tooth. Tarsi missing from all legs of the unique holotype. Anterior femur with perimarginal groove; surface with close, shallow, moderate punctures bearing extremely short, fine, almost invisible setae. Trochanter moderately large, ventrally concave. Middle and hind

tibiae slender, only very slightly bowed. Spurs and tarsi missing. Middle and hind femora slightly arcuate, surface with punctures separated by about three diameters of the fine punctures near base and posterior margin, gradually larger along anterior margin and outward to apex, where they are coarse and slightly closer together, usually showing extremely short setae except for two or three longer setae at knee. Middle femur with complete posterior marginal line; hind femur with line inward from knee less than half femoral length.

Diagnosis: Differs from other species of *Euparixia* in the pronotal outline, simply convex elytral intervals, and by the peculiar pear-shaped depression of the mesosternum.

Specimens examined: Unique holotype. Only data: Costa Rica (USNM).

Host: Unknown, but probably *Atta colombica* Guer. or *A. cephalotes* (L.).

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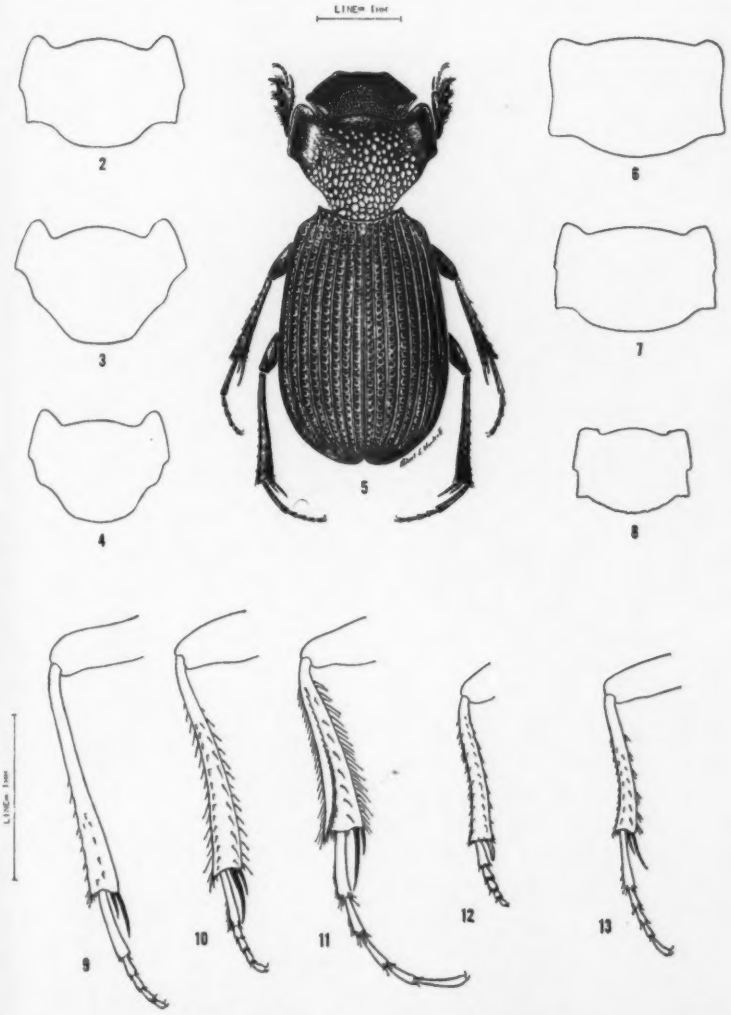

FIGURES 2–13.—Pronotal outline: 2, *Euparixia duncani* Brown; 3, *Euparixia bruneri* Chapin; 4, *Euparixia formica* Hinton; 6, *Euparia castanea* Serville; 7, *Euparixia costaricensis* Hinton; 8, *Euparixoides cribratus* Hinton. Holotype: 5, *Euparixia moseri*, new species. Posterior tibia and tarsus: 9, *Euparixia moseri*, new species; 10, *Euparia castanea* Serville; 11, *Pseudataenius socialis* (Horn); 12, *Euparixoides cribratus* Hinton; 13, *Cartwrightia intertribalis* Islas. (Drawn by R. E. Woodruff.)